

Serial No. 09/667,408

Multifunction Data Port

Reply to Office Action of 1/23/2008

REMARKS

The Applicant has, with this communication, added Claims 60, 61 and 62 and amended Claims 30, 31, 32, 33, 36, 37, 40, 41, 42, 45, 47, 49, 52, 56, 57 and 59 in response to the Office Action of 1/23/2008. These modifications by the Applicant more clearly define the present invention and clearly illustrate the differences between the said multi function data port invention and the prior art cited by the Examiner Borissov, specifically Tracy, McEachern, and McNamara, et. al. The Applicant's said data port invention is specified and claims have been made, and said claims have been modified and added to, and clearly show that the said invention makes an independent measurement of power use, from the standard electric meter, and this measurement value is compared with the measurement value from said standard utility power meter.

The said data port invention is not a power meter per se, or a power disturbance monitor per se, but a novel, unobvious and useful device that permits better control of the power grid, and creates, stores and calculates vital information for utilities and utility users, and permits real time communication of that information to and with the utility and utility user. It is, therefore, unlike Tracy, McEachern, et.al.. more than a utility-centric device, but is also a utility customer-centric device, with the resulting synergy and novelty clearly distinguishing the subject invention from prior art. The following is in additional response to Examiner Borissov in the Office Action of 01/23/2008:

"Claim Rejections-35 USC sec.112"

This objection of Claims 30-33 for indefiniteness and "failing to particularly point out and claim the subject matter which applicant regards as the invention," should be reconsidered and allowed because at least some of the Examiner's objections are not about subject matter, but are instead "*de minimus*" quibbling about the applicant's language: For example, "communicate

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said data" refers to the data in Claim 30 a), to wit, Voltage and current data, among other parameters, and has been corrected herein, along with similar rejections of claim based on use of language in Claims 31, 32, 33, 36, 37, 39, 40, 41, 42, and 59.

"Claim Rejections-35 USC sec. 103" – citing prior art of Tracy (US 6,150,955), et. al. and McEachern (US 5,530,738), also McNamara(5,528,507) at page 4 of 01/23/2008 Office Action:

Notwithstanding the previous and the following arguments in support of the non obvious present data port invention, the prior art, i.e, Tracy, et. al., cited by Examiner Borissov, was apparently not deemed by any other Examiner of this patent, or of the patents cited by Examiner Borissov, as prior art following on each other. Therefore, other Examiners apparently approved and allowed for issuance of the patents cited by Borissov, and such alleged prior art and alleged obviousness cited by said Examiner as alleged extensions of prior art to the subject invention, were not in fact deemed prior art at the time, but are now cited so by Examiner Borissov.

The Examiner's citation of the KSR case, 127 S.Ct. at 1740, 82 USPQ2d at 1396 and the mistaken citation of the Board decision, "Ex arte Smith", which is Ex Parte Smith, USPQ2nd, slip. Op. at 20. (Bd.Pat. App. & Interf. June, 25, 2007) is made by Examiner Borissov to say to the Applicant that the Applicant's analysis of prior art as being distinguished from the subject invention means essentially nothing, and that the most recent Office Action with respect to prior art "forecloses the argument that a specific teaching, suggestion, or motivation is required to support a finding of obviousness" (01/23/2008 Office Action at p.11). This TSM test, from the Graham v. John Deere case was also addressed in the KSR case cited by Examiner Borissov.

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If the Examiner's analysis of the oblivious of prior art is correct, then prior examiners' and USPTO decisions to issue patents based on said prior art should be deemed void for not in fact noting at any time that this particular line of issued patents constitutes prior art to each subsequent issued patent.

The Supreme Court case, KSR International v. Teleflex Inc, et.al, decided April 30, 2007, attached here in full in the Appendix and cited above by Examiner Borissov, states clearly in the Syllabus of the holding:

" Held: The Federal District Court addressed the obviousness question in a narrow, rigid manner that is inconsistent with sec.103 and this Court's precedents.... A court must ask whether the improvement is more than the predictable use of prior-art elements according to their established functions. Following these principles may be difficult if the claimed subject matter involves more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. To determine whether there was an apparent reason to combine the known elements in the way a patent claims, it will often be necessary to look to interrelated teachings of multiple patents; to the effects of demands known to the design community or present in the market place; and to the background knowledge possessed by a person having ordinary skill in the art. To facilitate review, this analysis should be made explicit. But it need not seek out precise teachings directed to the challenged claim's specific subject matter, for a court can consider the inferences and creative steps a person of ordinary skill in the art would employ." (pp. 3-4 of the USSC slip op.)
(emphasis added by Applicant here).

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The Examiner should be reminded that he is not a court of law, and that before this or any other matter becomes a legal court issue, the Applicant here in pro se intends to rely on the rules and procedures of the USPTO, including those cited here, requesting the constructive assistance and suggestions of the Examiner as provided in sections 707.07(j) and 2173.02 of the U S Manual of Patent Practice. The Applicant also reads the KSR case in its entirety, not in the mere citation by Examiner Borissov in the 01/23/2008 Office Action to which this is in reply. Therefore please note the U.S Supreme Court's words in the holding of the KSR case, in the paragraph following the one already quoted: : "... it will often be necessary to look to interrelated teachings of multiple patents; to the effects of demands known to the design community or present in the market place; and to the background knowledge possessed by a person having ordinary skill in the art. (emphasis added by Applicant). "Demands known to the design community and present in the market place"—these are clear terms by the highest Court in the land. The Applicant's application here was filed in 2001 and to this day, April 15, 2008, and with numerous citations in this document, and in prior communications with the USPTO, incorporated by reference, about the needs of the electric utility, the demands of the North American Power Grid, there is no extension of the prior art cited by Examiner Borissov in the market place that resembles the almost seven year old invention of the Applicant. This means that what the U.S. Supreme Court says in KSR is important to the Applicant: the Applicant believes that the record of this entire Application for the subject invention shows that the obviousness question by Examiner Borissov has indeed been "addressed in a narrow, rigid manner that is inconsistent with sec.103" of the Patent Act.

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Justice Kennedy, in rendering the Court's unanimous opinion in KSR, is very clear about the subject of obviousness analysis: "The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. The diversity of inventive pursuits and of modern technology counsels against limiting the analysis in this way. In many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature, will drive design trends...In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim." (slip op. at 15-16) (emphasis added by Applicant).

When Examiner Borissov says "this is a case where the improvements are no more than the predictable use of prior art elements according to their established functions, no further analysis is required by the Examiner." (01/23/2008 Office Action at p. 11), and then cites the U.S. Supreme Court KSR case, this is an outright narrow and rigid approach to the obviousness questions raised in the 01/23/2008 Office Action and in previous Office Actions, incorporated herein by reference, and addressed by the Applicant, in turn, and here. The foregoing and the following analysis here are not based on paraphrased observations of the U.S. Supreme Court's ruling in KSR, as was given by Examiner Borissov in his rejections of the Applicant's claims for what is termed obviousness: instead, presented here in as full a context as practicable, are the actual words of the U.S. Supreme court in its actual holding in the KSR case. As the Court said, regarding the analysis of obviousness, in KSR: A patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the

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prior art. Although common sense directs caution as to a patent application claiming as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does. Inventions usually rely on building blocks long since uncovered, and claimed discoveries almost necessarily will be combinations of what, in some sense is already known. Helpful insights, however, need not become rigid and mandatory formulas. If it is so applied, the TSM (the Federal Circuit Court's "teaching, suggestion, or motivation" test in Graham v. John Deere, 383 U.S 1, 17-88 as cited in slip op. at p.2, and by the Examiner in subject Office Action at p.11) test is incompatible with this Court's precedents... There is no necessary inconsistency between the test and the Graham analysis. But a court errs where, as here, it transforms general principle into a rigid rule limiting the obviousness inquiry." (slip op. at pp.4-5.)

It is obvious to the Applicant that Examiner Borissov is transforming a general principle or set of same, into a rigid rule limiting the obviousness inquiry and arguments by the Applicant, indeed by foreclosing arguments from the Applicant, based on a misapplication or misreading of Supreme Court law, as clearly shown by the exact quotations by the Applicant from the actual KSR Court case, the same case cited but without quotation by the Examiner. The Applicant here, however, chooses to pursue his Application, with the appropriate analysis of how the subject invention is distinguished from prior art cited by the Examiner, specifically following the clear guidelines in the holding in the KSR case.

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Tracy, for example, cited by Examiner Borissov in the 01/23/2008 Office Action, and in prior USPTO communications, is understood by the Applicant to measure the number of disk rotations of a typical mechanical utility meter (C. 2, L. 6-9). His improved system is "capable of calculating and storing utility usage from the number of disk rotations". Such mechanical utility meters cost less than \$50 and are limited to the measurement of total power consumption. Tracy teaches that the data from said meters is transmitted over the digital control channel. Arguments about the capacities and technology of the wireless cell-phone based control channel vs. the Internet have been made by the Applicant here, and are incorporated by reference, but the Applicant's invention does not use the control channel and could not supply the inventions novel features over the control channel, as does Tracy.

McEachern and King *et al.* each teach improvements to the displays of "power parameter recording instruments". McEachern discloses his use of synthetic speck as an improvement on the earlier graphic display monitors for said power parameter instruments (C.2 L4-7). He makes reference to his earlier patents on displays of said instruments (4,642,563 & 4,694,402) and identifies the producers of said power disturbance instruments as Dranetz Technologies and Basic Measuring Instruments (C. 1, L. 54-65; C.2, L.19-30). Said companies have since merged and Dranetz-BMI is recognized as the industry leader for said power disturbance monitors referenced by McEachern. For more than 30 years Dranetz-BMI has provided said instruments to measure power disturbances such as VAR or power factor, harmonics, frequency variations, high frequency noise and power factor. These power monitors are in SCADA (Supervisory Control and Data Acquisition) centers, which control the distribution of electric power over the North Atlantic Power Grid (NAPG). It is well known in the art that said SCADA centers with said

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Dranetz-BMI power monitors are able to measure electrical disturbances. Said electric utilities also know that said Dranetz-BMI power monitors are over 200 to 400 times more expensive than said utility power meters referenced by Tracy. The current price list for Dranetz-BMI Power Analyzers is incorporated by reference and said price list includes reconditioned models of said power monitors priced from a minimum of \$4,995.00 to \$11,150.00. The Applicant's data port invention, in one preferred embodiment, would cost less than ninety dollars and would easily interface with standard electric meters and other monitoring equipment, including the cited Dranetz-BMI-McEachern devices.

The power disturbance monitors referenced by McEachern are clearly not equivalent to utility power meters referenced by Tracy. Tracy has taught a system which combines a mechanical utility power meter with communication over the said digital control channel. It does not now appear, and did not appear to the Examiner who granted the patents at the time, to be obvious to one of ordinary skill in the art to modify said Tracy system to be able to measure said high speed Voltage transients and harmonics as disclosed by McEachern using said Dranetz-BMI power disturbance monitors. The ability of the said data port subject invention to provide low cost real time measurements of transients, harmonics and electrical noise, and to compare these and other parameters with the standard utility meter, is a clear improvement that distinguishes it from systems like Tracy and McNamara, and others cited by Examiner Borissov.

The U. S. Department of Energy, in its solicitations for the Small Business Innovation and Research (SBIR) program, from which the inventor here was awarded the Tibbetts prize in 1995, has identified the availability of low cost sensors to provide such real time data from all parts of

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the NAPG as the cross cutting requirement for more efficient operation of said grid and the reduction of service interruptions. It is the Applicant's intention, in one preferred embodiment, to have the subject data port invention interface with such system of sensors.

Physics teaches that the measurement of a high frequency signal requires a detector with comparable response time. The power detectors as referenced by Tracy have very slow response times and a person skilled in the art would not use such detectors to measure fast transits and harmonics. Applicant for the subject data port invention is a Fellow of the American Physics Society, a Professor Emeritus of Physics and qualified as an expert witness in such matters.

The said analog to digital converters in the said multi function data port provide the said digital data from measurement of the said current and said Voltage to the said computer in said data port. It is well known in the art that analog to digital converters and microprocessors can process data at speeds in excess of one mega Hertz. This combination has the ability to detect the shape of mille second power disturbances and high frequency transits which are often the first warning or precursors of breakdowns, leading to brownouts and blackouts. The said data port invention permits the local processing of the higher digitized data rates required to determine the high frequency components of current and Voltage and, in one preferred embodiment, the present invention can send a warning message to said electric utility only when preset thresholds are exceeded.

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The early notice of potential problems can be critical to the Supervisory Control and Data Acquisition (SCADA) system used by utility companies for over twenty years, and by said utility referenced in the claims of the subject invention. It is critical for said SCADA system to be able to respond within mille seconds to potential problems. It can take less than one second for a breakdown to propagate through the distribution system and force large scale blackouts of power. The said local data processing in said data port invention, in one embodiment, permits filtering out of said disturbance data from locations with normal operation and only alerting said SCADA system within mille seconds of the location of a power disturbance which requires an emergency response from said utility.

The problems successfully addressed by the present novel invention are two fold: first one needs massive amounts of data to identify high frequency transits and second, the system needs to identify in real time the critical power disturbances and promptly alert the SCADA system. The present invention's ability to filter out routine data, and process critical data described herein, saves the utility bandwidth necessary to receive prompt notice of problems. Said invention does not send unprocessed data to be processed at a remote location and it does not overload the Internet or an intranet with routine information, as prior art would seem to indicate. The specifications for the present data port invention clearly state that the multi function data port is designed to detect Voltage transits, harmonics and other power disturbances, such as lighting strikes and electrical shorts which can result in massive surges of current in fractions of a mille second. The ability to detect such events in real time requires rapid measurement of the structure of the current and Voltage, as determined by the present invention in one preferred embodiment.

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There is a major difference between routine measurement of power use and a novel and useful power management device as in the present invention which can detect and measure power disturbances within mille seconds, and stores and transmits same to the said utility as well as the said utility user, thus reducing potential damage to said utility's generators and transmission system. On August 14, 2003, portions of the NAPG serving 50 million people with an electric load of 61,800 mega Watts lost electric power [1] Connecticut, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Vermont and Ontario, Canada were affected. The next day, President Bush and Prime Minister Chrétien ordered the formation of the U.S. - Canada Power System Outage Task Force (POTF) to investigate the reasons for this blackout [1 & 3]. This blackout cost was estimated to be from \$6 to \$10 billion.

The low cost real-time sensors, that are also connected to the subject data port invention and made novel and useful thereby, in one preferred embodiment, can be deployed over a secure network and will thereby complement advanced VAR control technologies and provide required data at speeds necessary to alleviate many of the problems addressed by the DOE's Transmission Grid Study report in May, 2002[4 p.61-65]. In the absence of detailed knowledge, system operators at the 150-plus grid operations centers have often been forced to reduce the transmitted power below safe operating levels. The subject data port invention provides for real time mille-second monitoring of the power system, at many points contiguous to standard electric meters/ This can permit automatic alerts and potential compensation to prevent blackouts [1:p64], in addition to increasing the efficiency of the NAPG. There are estimates that the entire grid could be able to run at some 20% higher capacities if system operators had access to detailed knowledge from all portions of the grid.

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There is a clear difference in both form and function between a system with a central computer receiving raw data from a million meters and a system, evidenced by the Applicant's invention here, with a million computers in the said data port invention first processing this data at the user's site, and storing said data, and only transmitting to the utility's computer when the It is, therefore, unlike Tracy, McEachern, et.al.. more than a utility-centric device, but is also a utility customer-centric device, with the resulting synergy and novelty clearly distinguishing the subject invention from prior art. The following is in additional response to Examiner Borissov in the Office Action of 01/23/2008:

processed data from the meter interface unit exceeds preset parameters.. In the case of the subject data port invention, the data is collected by, processed and stored in the said multifunction data port for use by both the utility and its customer.

The data rate for unprocessed data able to measure said transits and harmonics from said million utility users, not connected to said data port invention, would be over 30 gigabytes per second in a medium sized city. It would require a super computer to filter out the routine data in said data stream and find the source of power disturbances within mille-seconds. On the other hand, said distributed systems, with said local processing in said data port invention, can identify the source of power disturbances and transmit said critical data to the utility's SCADA computer within mille-seconds, clearly, again, distinguishing the present invention from the points raised by Examiner Borissov in "Claim Rejections – 35 USC sec. 112" at pages 2-4 of the 01/23/2008 Office Action to which this document replies.

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Transits and harmonics can damage electronic equipment and transformers; indeed, over \$1 billion in damages already occurs annually because of the failure of utilities to deliver "digital grade power" to the almost one billion microprocessors in appliances and electronics in U.S. buildings and households. These unrecorded and uncorrected disturbances are often the first symptoms of Voltage breakdowns. When there is an incident on the power grid, the utility needs to quickly identify the problem and its location. The power disturbance in Cincinnati, Ohio on August 14, 2003 caused loss of electrical power for 50 million people within mille seconds.

The North American Power Grid (NAPG) is connected to each utility user and disturbances can propagate if they are not quickly corrected. The availability of local information, enabled by the present data port invention, permits the utility to correct for phase and harmonics before potentially catastrophic disturbances can spread. In addition, there is an increasing necessity for "digital grade" power, which is free of excessive electrical noise and harmonics caused by solid-state power supplies and which can efficiently flow to the over 700 million microprocessors embedded in many household appliances and electronics.

The present data port invention provides for the immediate identification of the source of either electrical noise or harmonics, and other parameters, and thereby permits the utility to correct the problem and/or identify utility users responsible for excessive electrical noise. A detailed record of power disturbances can be stored in the memory component of the said data port invention located at the site of each said utility user. Said record of said data is available for real time as well as later review by said utility and said utility user.

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In reference to claim 40, as revised herein, and according to the Office Action by Examiner Borissov, Berkeley teaches the use of a utility controlled on-off limit switch on the utility user's thermostats (C. 14 L. 20-32) and a charge of higher rates for customers who turn off said limit switch. Brown teaches the use of a HVAC control unit which the customer can turn on and off (C. 10, L. 65-67). Both Brown and Berkeley use an external switch installed by the utility to control power use by the utility. The present data port invention can be used to reduce power needs during times of peak power use without the need for any limit switch controlled by the utility. At times of peak power demand the present invention, according to Claim 40, provides that a said utility-specified program can raise the thermostat setting by one or two degrees and it can be reset at any time by the said utility user. Thereby, the present invention makes use of inertia on the part of both buildings and customers. The specific heat of most buildings limits the speed of the change in temperature and people seldom notice a change of a couple of degrees in the temperature.

In the present data port invention, there is no need to switch off or control the said utility user's HVAC equipment. If a few of the said utility customers choose to reset their said programmed thermostat, it is of little consequence to the said utility utilizing the present invention. If the said temperature settings on said programmed thermostat are raised by one degree on a ten thousand thermostat deployment, and a hundred customers reset their thermostat, the utility load is still reduced at times of peak demand. There is no need to punish the users who reset their thermostats. All said utility customers who install said programmable thermostats, connected to said data port invention, enjoy the same lower electric rates, in one embodiment of the subject invention.

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The ability of the said utility user to control a said programmable thermostat, or other device, installed by said utility user, and connected to said data port invention, is a very important difference between the subject invention and prior art cited by Examiner Borissov using utility controlled devices. Various Public Service Commissions have rejected installation by utilities of devices in the homes of utility users, which limit the freedom of said user to control power use. Methods to control peak demand which use utility controlled limit switches and devices such as those taught by Brown and Berkeley are not permitted in California, among other states. The subject invention of the data port is an unique improvement and a demonstrated novelty since it provides a method to reduce power use that has not been prohibited. The subject invention provides said utility user with full access to the said utility usage data. This method embodiment of the subject data port invention also allows for said utility user to remotely reduce power usage and costs, by accessing the said computer in the said data port invention over the Internet, while the said utility user is away from the said household.

Claim 60, as revised herein, makes use of said power switches as used by Berkeley, but said switches in Berkeley are not subject to control by said electric utility, as there are in the subject invention. The subject invention's said program in said computer in said user's data port directs said switches to limit power use in times of peak power and to reduce peak demand for power by said utility user. Electric utilities can have rates that depend on both peak demand and power use. The ability to provide local control of peak demand permits greater efficiency of said NAPG.

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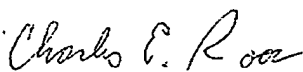
Claim 61, as added herein, makes use of the ability of said data port invention to make said independent measurements of said power use and compare, in real time, said use to the said power use determined by said standard utility meter. Attempts by said utility user to bypass or slow the meter movement in said utility meter will generate a difference between said two readings, with a greater accuracy in determination and calculation by the said data port invention. It is not necessary that the power measurement computed by said data port satisfy the calibration requirement for utility meters since the power use for said utility meter is used for commercial use. If there is a difference between the two independent readings, between the standard meter and the subject invention data port, the electric utility is aware of possible problems with said utility meter and can take corrective action.

Claim 62, as added herein, is important to the provision of digital grade electric power to the said utility user's household. The on site measurement of electrical noise by the subject data port invention permits the electric utility to identify in real time, or at subsequent times permitted by the storage feature of the said data port, the source of said noise and either correct it or charge said utility user a higher rate for generation of said electric noise. There are estimates that some 15% of power use will be for electronic power supplies, which use solid state switches and can be a source of harmonics.

The Applicant has previously amended Specification and Claims of this application, as the written record clearly shows. The Applicant has also requested and was granted two in person sessions with both Examiner Borissov and Supervisor Hayes, and following said in-person sessions, and each Office Action, has attempted to make said amendments and define novel

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structure which is also unobvious in the present invention. If, for any reason, this application is now not believed to be in full compliance for allowance, the applicant respectfully requests the constructive assistance and suggestions of the Examiner as provided in sections 707.07(j) and 2173.02 of the U S Manual of Patent Practice. After the revised claims and other matter in the reply herein, have been reviewed, the Applicant requests another in person meeting prior to any adverse Office Action, in anticipation of full compliance for allowance.



Charles E. Roos, Applicant *In Pro Se*

References:

1. *"Final Report on the August 14, 2003 Blackout in the United States and Canada : Causes and Recommendations"*, 13 and 28. U.S.-Canada Power System Outage Task Force, April 2004.
2. Gellings, C.W. & Yeager, K. E. *Transforming the Electric Infrastructure*, Physics Today. Vol. 57, No. 12, pp. 45 – 51, December, 2004
3. U.S.- Canada Power System Outage Task Force Interim Report, November, 2003
- 4 *"National Transmission Grid Study* U.S. Department of Energy, May 2002, p. 45, 61-6, F1 & 9
5. KSR case, 127 S.Ct. at 1740, 82 USPQ2d at 1396

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ATTACHMENTS

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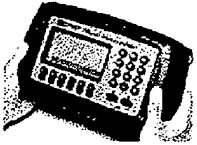
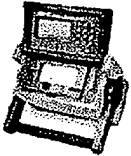

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	PP1 - (Refurbished) The portable PP1 performs as multiple instruments in one under even the most challenging field conditions. The PP1 features a large, easy-to-read screen and built-in printer for instant analysis and troubleshooting.	Special Price: \$11,150 (USD) Comes with printer, PQ Plus TaskCard and Dran-View software
	658 - (Refurbished) This PQ workhorse captures high-speed transients, while serving as a digitized oscilloscope, true RMS voltmeter, harmonics distortion analyzer, power disturbance meter and strip chart recorder. The 658 can monitor up to 12 channels-4 high	Special Price: \$10857 (USD) Includes Dran-View visualization, analysis and report writing software

(Slip Opinion)

OCTOBER TERM, 2006

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Syllabus

NOTE: Where it is feasible, a syllabus (headnote) will be released, as is being done in connection with this case, at the time the opinion is issued. The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader. See *United States v. Detroit Timber & Lumber Co.*, 200 U. S. 321, 337.

SUPREME COURT OF THE UNITED STATES

Syllabus

KSR INTERNATIONAL CO. *v.* TELEFLEX INC. ET AL.CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR
THE FEDERAL CIRCUIT

No. 04-1350. Argued November 28, 2006—Decided April 30, 2007

To control a conventional automobile's speed, the driver depresses or releases the gas pedal, which interacts with the throttle via a cable or other mechanical link. Because the pedal's position in the footwell normally cannot be adjusted, a driver wishing to be closer or farther from it must either reposition himself in the seat or move the seat, both of which can be imperfect solutions for smaller drivers in cars with deep footwells. This prompted inventors to design and patent pedals that could be adjusted to change their locations. The Asano patent reveals a support structure whereby, when the pedal location is adjusted, one of the pedal's pivot points stays fixed. Asano is also designed so that the force necessary to depress the pedal is the same regardless of location adjustments. The Redding patent reveals a different, sliding mechanism where both the pedal and the pivot point are adjusted.

In newer cars, computer-controlled throttles do not operate through force transferred from the pedal by a mechanical link, but open and close valves in response to electronic signals. For the computer to know what is happening with the pedal, an electronic sensor must translate the mechanical operation into digital data. Inventors had obtained a number of patents for such sensors. The so-called '936 patent taught that it was preferable to detect the pedal's position in the pedal mechanism, not in the engine, so the patent disclosed a pedal with an electronic sensor on a pivot point in the pedal assembly. The Smith patent taught that to prevent the wires connecting the sensor to the computer from chafing and wearing out, the sensor should be put on a fixed part of the pedal assembly rather than in or on the pedal's footpad. Inventors had also patented self-contained modular sensors, which can be taken off the shelf and attached to any

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mechanical pedal to allow it to function with a computer-controlled throttle. The '068 patent disclosed one such sensor. Chevrolet also manufactured trucks using modular sensors attached to the pedal support bracket, adjacent to the pedal and engaged with the pivot shaft about which the pedal rotates. Other patents disclose electronic sensors attached to adjustable pedal assemblies. For example, the Rixon patent locates the sensor in the pedal footpad, but is known for wire chafing.

After petitioner KSR developed an adjustable pedal system for cars with cable-actuated throttles and obtained its '976 patent for the design, General Motors Corporation (GMC) chose KSR to supply adjustable pedal systems for trucks using computer-controlled throttles. To make the '976 pedal compatible with the trucks, KSR added a modular sensor to its design. Respondents (Teleflex) hold the exclusive license for the Engelgau patent, claim 4 of which discloses a position-adjustable pedal assembly with an electronic pedal position sensor attached a fixed pivot point. Despite having denied a similar, broader claim, the U. S. Patent and Trademark Office (PTO) had allowed claim 4 because it included the limitation of a fixed pivot position, which distinguished the design from Redding's. Asano was neither included among the Engelgau patent's prior art references nor mentioned in the patent's prosecution, and the PTO did not have before it an adjustable pedal with a fixed pivot point. After learning of KSR's design for GMC, Teleflex sued for infringement, asserting that KSR's pedal system infringed the Engelgau patent's claim 4. KSR countered that claim 4 was invalid under §103 of the Patent Act, which forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art."

Graham v. John Deere Co. of Kansas City, 383 U. S. 1, 17-18, set out an objective analysis for applying §103: "[T]he scope and content of the prior art are . . . determined; differences between the prior art and the claims at issue are . . . ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." While the sequence of these questions might be reordered in any particular case, the factors define the controlling inquiry. However, seeking to resolve the obviousness question with more uniformity and consistency, the Federal Circuit has employed a "teaching, suggestion, or motivation" (TSM) test, under which a pat-

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ent claim is only proved obvious if the prior art, the problem's nature, or the knowledge of a person having ordinary skill in the art reveals some motivation or suggestion to combine the prior art teachings.

The District Court granted KSR summary judgment. After reviewing pedal design history, the Engelgau patent's scope, and the relevant prior art, the court considered claim 4's validity, applying *Graham's* framework to determine whether under summary-judgment standards KSR had demonstrated that claim 4 was obvious. The court found "little difference" between the prior art's teachings and claim 4: Asano taught everything contained in the claim except using a sensor to detect the pedal's position and transmit it to a computer controlling the throttle. That additional aspect was revealed in, e.g., the '068 patent and Chevrolet's sensors. The court then held that KSR satisfied the TSM test, reasoning (1) the state of the industry would lead inevitably to combinations of electronic sensors and adjustable pedals, (2) Rixon provided the basis for these developments, and (3) Smith taught a solution to Rixon's chafing problems by positioning the sensor on the pedal's fixed structure, which could lead to the combination of a pedal like Asano with a pedal position sensor.

Reversing, the Federal Circuit ruled the District Court had not applied the TSM test strictly enough, having failed to make findings as to the specific understanding or principle within a skilled artisan's knowledge that would have motivated one with no knowledge of the invention to attach an electronic control to the Asano assembly's support bracket. The Court of Appeals held that the District Court's recourse to the nature of the problem to be solved was insufficient because, unless the prior art references addressed the precise problem that the patentee was trying to solve, the problem would not motivate an inventor to look at those references. The appeals court found that the Asano pedal was designed to ensure that the force required to depress the pedal is the same no matter how the pedal is adjusted, whereas Engelgau sought to provide a simpler, smaller, cheaper adjustable electronic pedal. The Rixon pedal, said the court, suffered from chafing but was not designed to solve that problem and taught nothing helpful to Engelgau's purpose. Smith, in turn, did not relate to adjustable pedals and did not necessarily go to the issue of motivation to attach the electronic control on the pedal assembly's support bracket. So interpreted, the court held, the patents would not have led a person of ordinary skill to put a sensor on an Asano-like pedal. That it might have been obvious to try that combination was likewise irrelevant. Finally, the court held that genuine issues of material fact precluded summary judgment.

Held: The Federal Circuit addressed the obviousness question in a narrow, rigid manner that is inconsistent with §103 and this Court's

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precedents. KSR provided convincing evidence that mounting an available sensor on a fixed pivot point of the Asano pedal was a design step well within the grasp of a person of ordinary skill in the relevant art and that the benefit of doing so would be obvious. Its arguments, and the record, demonstrate that the Engelgau patent's claim 4 is obvious. Pp. 11–24.

1. *Graham* provided an expansive and flexible approach to the obviousness question that is inconsistent with the way the Federal Circuit applied its TSM test here. Neither §103's enactment nor *Graham*'s analysis disturbed the Court's earlier instructions concerning the need for caution in granting a patent based on the combination of elements found in the prior art. See *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U. S. 147, 152. Such a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. See, e.g., *United States v. Adams*, 383 U. S. 39, 50–52. When a work is available in one field, design incentives and other market forces can prompt variations of it, either in the same field or in another. If a person of ordinary skill in the art can implement a predictable variation, and would see the benefit of doing so, §103 likely bars its patentability. Moreover, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond that person's skill. ~~A court must ask whether~~ the improvement is more than the predictable use of prior-art elements according to their established functions. Following these principles may be difficult if the claimed subject matter involves more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. To determine whether there was an apparent reason to combine the known elements in the way a patent claims, it will often be necessary to look to interrelated teachings of multiple patents; to the effects of demands known to the design community or present in the marketplace; and to the background knowledge possessed by a person having ordinary skill in the art. To facilitate review, this analysis should be made explicit. But it need not seek out precise teachings directed to the challenged claim's specific subject matter, for a court can consider the inferences and creative steps a person of ordinary skill in the art would employ. Pp. 11–14.

(b) The TSM test captures a helpful insight: A patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. Although common sense directs caution as to a patent application claiming as

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innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does. Inventions usually rely upon building blocks long since uncovered, and claimed discoveries almost necessarily will be combinations of what, in some sense, is already known. Helpful insights, however, need not become rigid and mandatory formulas. If it is so applied, the TSM test is incompatible with this Court's precedents. The diversity of inventive pursuits and of modern technology counsels against confining the obviousness analysis by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasizing the importance of published articles and the explicit content of issued patents. In many fields there may be little discussion of obvious techniques or combinations, and market demand, rather than scientific literature, may often drive design trends. Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, for patents combining previously known elements, deprive prior inventions of their value or utility. Since the TSM test was devised, the Federal Circuit doubtless has applied it in accord with these principles in many cases. There is no necessary inconsistency between the test and the *Graham* analysis. But a court errs where, as here, it transforms general principle into a rigid rule limiting the obviousness inquiry. Pp. 14–15.

(c) The flaws in the Federal Circuit's analysis relate mostly to its narrow conception of the obviousness inquiry consequent in its application of the TSM test. The Circuit first erred in holding that courts and patent examiners should look only to the problem the patentee was trying to solve. Under the correct analysis, any need or problem known in the field and addressed by the patent can provide a reason for combining the elements in the manner claimed. Second, the appeals court erred in assuming that a person of ordinary skill in the art attempting to solve a problem will be led only to those prior art elements designed to solve the same problem. The court wrongly concluded that because Asano's primary purpose was solving the constant ratio problem, an inventor considering how to put a sensor on an adjustable pedal would have no reason to consider putting it on the Asano pedal. It is common sense that familiar items may have obvious uses beyond their primary purposes, and a person of ordinary skill often will be able to fit the teachings of multiple patents together like pieces of a puzzle. Regardless of Asano's primary purpose, it provided an obvious example of an adjustable pedal with a fixed pivot point, and the prior art was replete with patents indicating that such a point was an ideal mount for a sensor. Third, the

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court erred in concluding that a patent claim cannot be proved obvious merely by showing that the combination of elements was obvious to try. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. Finally, the court drew the wrong conclusion from the risk of courts and patent examiners falling prey to hindsight bias. Rigid preventative rules that deny recourse to common sense are neither necessary under, nor consistent with, this Court's case law. Pp. 15–18.

2. Application of the foregoing standards demonstrates that claim 4 is obvious. Pp. 18–23.

(a) The Court rejects Teleflex's argument that the Asano pivot mechanism's design prevents its combination with a sensor in the manner claim 4 describes. This argument was not raised before the District Court, and it is unclear whether it was raised before the Federal Circuit. Given the significance of the District Court's finding that combining Asano with a pivot-mounted pedal position sensor fell within claim 4's scope, it is apparent that Teleflex would have made clearer challenges if it intended to preserve this claim. Its failure to clearly raise the argument, and the appeals court's silence on the issue, lead this Court to accept the District Court's conclusion. Pp. 18–20.

(b) The District Court correctly concluded that when Engelgau designed the claim 4 subject matter, it was obvious to a person of ordinary skill in the art to combine Asano with a pivot-mounted pedal position sensor. There then was a marketplace creating a strong incentive to convert mechanical pedals to electronic pedals, and the prior art taught a number of methods for doing so. The Federal Circuit considered the issue too narrowly by, in effect, asking whether a pedal designer writing on a blank slate would have chosen both Asano and a modular sensor similar to the ones used in the Chevrolet trucks and disclosed in the '068 patent. The proper question was whether a pedal designer of ordinary skill in the art, facing the wide range of needs created by developments in the field, would have seen an obvious benefit to upgrading Asano with a sensor. For such a designer starting with Asano, the question was where to attach the sensor. The '936 patent taught the utility of putting the sensor on the pedal device. Smith, in turn, explained not to put the sensor on the pedal footpad, but instead on the structure. And from Rixon's known wire-chafing problems, and Smith's teaching that the pedal assemblies must not precipitate any motion in the connecting wires,

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the designer would know to place the sensor on a nonmoving part of the pedal structure. The most obvious such point is a pivot point. The designer, accordingly, would follow Smith in mounting the sensor there. Just as it was possible to begin with the objective to upgrade Asano to work with a computer-controlled throttle, so too was it possible to take an adjustable electronic pedal like Rixon and seek an improvement that would avoid the wire-chafing problem. Teleflex has not shown anything in the prior art that taught away from the use of Asano, nor any secondary factors to dislodge the determination that claim 4 is obvious. Pp. 20–23.

3. The Court disagrees with the Federal Circuit's holding that genuine issues of material fact precluded summary judgment. The ultimate judgment of obviousness is a legal determination. *Graham*, 383 U. S., at 17. Where, as here, the prior art's content, the patent claim's scope, and the level of ordinary skill in the art are not in material dispute and the claim's obviousness is apparent, summary judgment is appropriate. P. 23.

119 Fed. Appx. 282, reversed and remanded.

KENNEDY, J., delivered the opinion for a unanimous Court.

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NOTICE: This opinion is subject to formal revision before publication in the preliminary print of the United States Reports. Readers are requested to notify the Reporter of Decisions, Supreme Court of the United States, Washington, D. C. 20543, of any typographical or other formal errors, in order that corrections may be made before the preliminary print goes to press.

SUPREME COURT OF THE UNITED STATES

No. 04-1350

KSR INTERNATIONAL CO., PETITIONER v.
TELEFLEX INC. ET AL.

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF
APPEALS FOR THE FEDERAL CIRCUIT

[April 30, 2007]

JUSTICE KENNEDY delivered the opinion of the Court.

Teleflex Incorporated and its subsidiary Technology Holding Company—both referred to here as Teleflex—sued KSR International Company for patent infringement. The patent at issue, United States Patent No. 6,237,565 B1, is entitled “Adjustable Pedal Assembly With Electronic Throttle Control.” Supplemental App. 1. The patentee is Steven J. Engelgau, and the patent is referred to as “the Engelgau patent.” Teleflex holds the exclusive license to the patent.

Claim 4 of the Engelgau patent describes a mechanism for combining an electronic sensor with an adjustable automobile pedal so the pedal’s position can be transmitted to a computer that controls the throttle in the vehicle’s engine. When Teleflex accused KSR of infringing the Engelgau patent by adding an electronic sensor to one of KSR’s previously designed pedals, KSR countered that claim 4 was invalid under the Patent Act, 35 U. S. C. §103, because its subject matter was obvious.

Section 103 forbids issuance of a patent when “the differences between the subject matter sought to be pat-

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ented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

In *Graham v. John Deere Co. of Kansas City*, 383 U. S. 1 (1966), the Court set out a framework for applying the statutory language of §103, language itself based on the logic of the earlier decision in *Hotchkiss v. Greenwood*, 11 How. 248 (1851), and its progeny. See 383 U. S., at 15-17. The analysis is objective:

"Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *Id.*, at 17-18.

While the sequence of these questions might be reordered in any particular case, the factors continue to define the inquiry that controls. If a court, or patent examiner, conducts this analysis and concludes the claimed subject matter was obvious, the claim is invalid under §103.

Seeking to resolve the question of obviousness with more uniformity and consistency, the Court of Appeals for the Federal Circuit has employed an approach referred to by the parties as the "teaching, suggestion, or motivation" test (TSM test), under which a patent claim is only proved obvious if "some motivation or suggestion to combine the prior art teachings" can be found in the prior art, the nature of the problem, or the knowledge of a person having ordinary skill in the art. See, e.g., *Al-Site Corp. v. VSI*

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Int'l, Inc., 174 F.3d 1308, 1323–1324 (CA Fed. 1999). KSR challenges that test, or at least its application in this case. See 119 Fed. Appx. 282, 286–290 (CA Fed. 2005). Because the Court of Appeals addressed the question of obviousness in a manner contrary to §103 and our precedents, we granted certiorari, 547 U. S. ____ (2006). We now reverse.

I

A

In car engines without computer-controlled throttles, the accelerator pedal interacts with the throttle via cable or other mechanical link. The pedal arm acts as a lever rotating around a pivot point. In a cable-actuated throttle control the rotation caused by pushing down the pedal pulls a cable, which in turn pulls open valves in the carburetor or fuel injection unit. The wider the valves open, the more fuel and air are released, causing combustion to increase and the car to accelerate. When the driver takes his foot off the pedal, the opposite occurs as the cable is released and the valves slide closed.

In the 1990's it became more common to install computers in cars to control engine operation. Computer-controlled throttles open and close valves in response to electronic signals, not through force transferred from the pedal by a mechanical link. Constant, delicate adjustments of air and fuel mixture are possible. The computer's rapid processing of factors beyond the pedal's position improves fuel efficiency and engine performance.

For a computer-controlled throttle to respond to a driver's operation of the car, the computer must know what is happening with the pedal. A cable or mechanical link does not suffice for this purpose; at some point, an electronic sensor is necessary to translate the mechanical operation into digital data the computer can understand.

Before discussing sensors further we turn to the me-

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chanical design of the pedal itself. In the traditional design a pedal can be pushed down or released but cannot have its position in the footwell adjusted by sliding the pedal forward or back. As a result, a driver who wishes to be closer or farther from the pedal must either reposition himself in the driver's seat or move the seat in some way. In cars with deep footwells these are imperfect solutions for drivers of smaller stature. To solve the problem, inventors, beginning in the 1970's, designed pedals that could be adjusted to change their location in the footwell. Important for this case are two adjustable pedals disclosed in U. S. Patent Nos. 5,010,782 (filed July 28, 1989) (Asano) and 5,460,061 (filed Sept. 17, 1993) (Redding). The Asano patent reveals a support structure that houses the pedal so that even when the pedal location is adjusted relative to the driver, one of the pedal's pivot points stays fixed. The pedal is also designed so that the force necessary to push the pedal down is the same regardless of adjustments to its location. The Redding patent reveals a different, sliding mechanism where both the pedal and the pivot point are adjusted.

We return to sensors. Well before Engelgau applied for his challenged patent, some inventors had obtained patents involving electronic pedal sensors for computer-controlled throttles. These inventions, such as the device disclosed in U. S. Patent No. 5,241,936 (filed Sept. 9, 1991) ('936), taught that it was preferable to detect the pedal's position in the pedal assembly, not in the engine. The '936 patent disclosed a pedal with an electronic sensor on a pivot point in the pedal assembly. U. S. Patent No. 5,063,811 (filed July 9, 1990) (Smith) taught that to prevent the wires connecting the sensor to the computer from chafing and wearing out, and to avoid grime and damage from the driver's foot, the sensor should be put on a fixed part of the pedal assembly rather than in or on the pedal's footpad.

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In addition to patents for pedals with integrated sensors inventors obtained patents for self-contained modular sensors. A modular sensor is designed independently of a given pedal so that it can be taken off the shelf and attached to mechanical pedals of various sorts, enabling the pedals to be used in automobiles with computer-controlled throttles. One such sensor was disclosed in U. S. Patent No. 5,385,068 (filed Dec. 18, 1992) ('068). In 1994, Chevrolet manufactured a line of trucks using modular sensors "attached to the pedal support bracket, adjacent to the pedal and engaged with the pivot shaft about which the pedal rotates in operation." 298 F. Supp. 2d 581, 589 (E.D. Mich. 2003).

The prior art contained patents involving the placement of sensors on adjustable pedals as well. For example, U. S. Patent No. 5,819,593 (filed Aug. 17, 1995) (Rixon) discloses an adjustable pedal assembly with an electronic sensor for detecting the pedal's position. In the Rixon pedal the sensor is located in the pedal footpad. The Rixon pedal was known to suffer from wire chafing when the pedal was depressed and released.

This short account of pedal and sensor technology leads to the instant case.

B

KSR, a Canadian company, manufactures and supplies auto parts, including pedal systems. Ford Motor Company hired KSR in 1998 to supply an adjustable pedal system for various lines of automobiles with cable-actuated throttle controls. KSR developed an adjustable mechanical pedal for Ford and obtained U. S. Patent No. 6,151,976 (filed July 16, 1999) ('976) for the design. In 2000, KSR was chosen by General Motors Corporation (GMC or GM) to supply adjustable pedal systems for Chevrolet and GMC light trucks that used engines with computer-controlled throttles. To make the '976 pedal compatible with the

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trucks, KSR merely took that design and added a modular sensor.

Teleflex is a rival to KSR in the design and manufacture of adjustable pedals. As noted, it is the exclusive licensee of the Engelgau patent. Engelgau filed the patent application on August 22, 2000 as a continuation of a previous application for U. S. Patent No. 6,109,241, which was filed on January 26, 1999. He has sworn he invented the patent's subject matter on February 14, 1998. The Engelgau patent discloses an adjustable electronic pedal described in the specification as a "simplified vehicle control pedal assembly that is less expensive, and which uses fewer parts and is easier to package within the vehicle." Engelgau, col. 2, lines 2-5, Supplemental App. 6. Claim 4 of the patent, at issue here, describes:

"A vehicle control pedal apparatus comprising:

a support adapted to be mounted to a vehicle structure;

an adjustable pedal assembly having a pedal arm moveable in for[e] and aft directions with respect to said support;

a pivot for pivotally supporting said adjustable pedal assembly with respect to said support and defining a pivot axis; and

an electronic control attached to said support for controlling a vehicle system;

said apparatus characterized by said electronic control being responsive to said pivot for providing a signal that corresponds to pedal arm position as said pedal arm pivots about said pivot axis between rest and applied positions wherein the position of said pivot remains constant while said pedal arm moves in fore and aft directions with respect to said pivot." *Id.*, col.

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6, lines 17–36, Supplemental App. 8 (diagram numbers omitted).

We agree with the District Court that the claim discloses “a position-adjustable pedal assembly with an electronic pedal position sensor attached to the support member of the pedal assembly. Attaching the sensor to the support member allows the sensor to remain in a fixed position while the driver adjusts the pedal.” 298 F. Supp. 2d, at 586–587.

Before issuing the Engelgau patent the U. S. Patent and Trademark Office (PTO) rejected one of the patent claims that was similar to, but broader than, the present claim 4. The claim did not include the requirement that the sensor be placed on a fixed pivot point. The PTO concluded the claim was an obvious combination of the prior art disclosed in Redding and Smith, explaining:

“Since the prior ar[t] references are from the field of endeavor, the purpose disclosed . . . would have been recognized in the pertinent art of Redding. Therefore it would have been obvious . . . to provide the device of Redding with the . . . means attached to a support member as taught by Smith.” *Id.*, at 595.

In other words Redding provided an example of an adjustable pedal and Smith explained how to mount a sensor on a pedal’s support structure, and the rejected patent claim merely put these two teachings together.

Although the broader claim was rejected, claim 4 was later allowed because it included the limitation of a fixed pivot point, which distinguished the design from Redding’s. *Ibid.* Engelgau had not included Asano among the prior art references, and Asano was not mentioned in the patent’s prosecution. Thus, the PTO did not have before it an adjustable pedal with a fixed pivot point. The patent issued on May 29, 2001 and was assigned to Teleflex.

Upon learning of KSR’s design for GM, Teleflex sent a

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warning letter informing KSR that its proposal would violate the Engelgau patent. "Teleflex believes that any supplier of a product that combines an adjustable pedal with an electronic throttle control necessarily employs technology covered by one or more" of Teleflex's patents. *Id.*, at 585. KSR refused to enter a royalty arrangement with Teleflex; so Teleflex sued for infringement, asserting KSR's pedal infringed the Engelgau patent and two other patents. *Ibid.* Teleflex later abandoned its claims regarding the other patents and dedicated the patents to the public. The remaining contention was that KSR's pedal system for GM infringed claim 4 of the Engelgau patent. Teleflex has not argued that the other three claims of the patent are infringed by KSR's pedal, nor has Teleflex argued that the mechanical adjustable pedal designed by KSR for Ford infringed any of its patents.

C

The District Court granted summary judgment in KSR's favor. After reviewing the pertinent history of pedal design, the scope of the Engelgau patent, and the relevant prior art, the court considered the validity of the contested claim. By direction of 35 U. S. C. §282, an issued patent is presumed valid. The District Court applied *Graham's* framework to determine whether under summary-judgment standards KSR had overcome the presumption and demonstrated that claim 4 was obvious in light of the prior art in existence when the claimed subject matter was invented. See §102(a).

The District Court determined, in light of the expert testimony and the parties' stipulations, that the level of ordinary skill in pedal design was "an undergraduate degree in mechanical engineering (or an equivalent amount of industry experience) [and] familiarity with pedal control systems for vehicles." 298 F. Supp. 2d, at 590. The court then set forth the relevant prior art, in-

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cluding the patents and pedal designs described above.

Following *Graham's* direction, the court compared the teachings of the prior art to the claims of Engelgau. It found "little difference." 298 F. Supp. 2d, at 590. Asano taught everything contained in claim 4 except the use of a sensor to detect the pedal's position and transmit it to the computer controlling the throttle. That additional aspect was revealed in sources such as the '068 patent and the sensors used by Chevrolet.

Under the controlling cases from the Court of Appeals for the Federal Circuit, however, the District Court was not permitted to stop there. The court was required also to apply the TSM test. The District Court held KSR had satisfied the test. It reasoned (1) the state of the industry would lead inevitably to combinations of electronic sensors and adjustable pedals, (2) Rixon provided the basis for these developments, and (3) Smith taught a solution to the wire chafing problems in Rixon, namely locating the sensor on the fixed structure of the pedal. This could lead to the combination of Asano, or a pedal like it, with a pedal position sensor.

The conclusion that the Engelgau design was obvious was supported, in the District Court's view, by the PTO's rejection of the broader version of claim 4. Had Engelgau included Asano in his patent application, it reasoned, the PTO would have found claim 4 to be an obvious combination of Asano and Smith, as it had found the broader version an obvious combination of Redding and Smith. As a final matter, the District Court held that the secondary factor of Teleflex's commercial success with pedals based on Engelgau's design did not alter its conclusion. The District Court granted summary judgment for KSR.

With principal reliance on the TSM test, the Court of Appeals reversed. It ruled the District Court had not been strict enough in applying the test, having failed to make "finding[s] as to the specific understanding or principle

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within the knowledge of a skilled artisan that would have motivated one with no knowledge of [the] invention' . . . to attach an electronic control to the support bracket of the Asano assembly." 119 Fed. Appx., at 288 (brackets in original) (quoting *In re Kotzab*, 217 F. 3d 1365, 1371 (CA Fed. 2000)). The Court of Appeals held that the District Court was incorrect that the nature of the problem to be solved satisfied this requirement because unless the "prior art references address[ed] the precise problem that the patentee was trying to solve," the problem would not motivate an inventor to look at those references. 119 Fed. Appx., at 288.

Here, the Court of Appeals found, the Asano pedal was designed to solve the "constant ratio problem"—that is, to ensure that the force required to depress the pedal is the same no matter how the pedal is adjusted—whereas Engelgau sought to provide a simpler, smaller, cheaper adjustable electronic pedal. *Ibid.* As for Rixon, the court explained, that pedal suffered from the problem of wire chafing but was not designed to solve it. In the court's view Rixon did not teach anything helpful to Engelgau's purpose. Smith, in turn, did not relate to adjustable pedals and did not "necessarily go to the issue of motivation to attach the electronic control on the support bracket of the pedal assembly." *Ibid.* When the patents were interpreted in this way, the Court of Appeals held, they would not have led a person of ordinary skill to put a sensor on the sort of pedal described in Asano.

That it might have been obvious to try the combination of Asano and a sensor was likewise irrelevant, in the court's view, because "[o]bvious to try" has long been held not to constitute obviousness." *Id.*, at 289 (quoting *In re Deuel*, 51 F. 3d 1552, 1559 (CA Fed. 1995)).

The Court of Appeals also faulted the District Court's consideration of the PTO's rejection of the broader version of claim 4. The District Court's role, the Court of Appeals

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explained, was not to speculate regarding what the PTO might have done had the Engelgau patent mentioned Asano. Rather, the court held, the District Court was obliged first to presume that the issued patent was valid and then to render its own independent judgment of obviousness based on a review of the prior art. The fact that the PTO had rejected the broader version of claim 4, the Court of Appeals said, had no place in that analysis.

The Court of Appeals further held that genuine issues of material fact precluded summary judgment. Teleflex had proffered statements from one expert that claim 4 “was a simple, elegant, and novel combination of features,” 119 Fed. Appx., at 290, compared to Rixon, and from another expert that claim 4 was nonobvious because, unlike in Rixon, the sensor was mounted on the support bracket rather than the pedal itself. This evidence, the court concluded, sufficed to require a trial.

II

A

We begin by rejecting the rigid approach of the Court of Appeals. Throughout this Court’s engagement with the question of obviousness, our cases have set forth an expansive and flexible approach inconsistent with the way the Court of Appeals applied its TSM test here. To be sure, *Graham* recognized the need for “uniformity and definiteness.” 383 U. S., at 18. Yet the principles laid down in *Graham* reaffirmed the “functional approach” of *Hotchkiss*, 11 How. 248. See 383 U. S., at 12. To this end, *Graham* set forth a broad inquiry and invited courts, where appropriate, to look at any secondary considerations that would prove instructive. *Id.*, at 17.

Neither the enactment of §103 nor the analysis in *Graham* disturbed this Court’s earlier instructions concerning the need for caution in granting a patent based on the combination of elements found in the prior art. For over a

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half century, the Court has held that a "patent for a combination which only unites old elements with no change in their respective functions . . . obviously withdraws what is already known into the field of its monopoly and diminishes the resources available to skillful men." *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U. S. 147, 152 (1950). This is a principal reason for declining to allow patents for what is obvious. The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. Three cases decided after *Graham* illustrate the application of this doctrine.

In *United States v. Adams*, 383 U. S. 39, 40 (1966), a companion case to *Graham*, the Court considered the obviousness of a "wet battery" that varied from prior designs in two ways: It contained water, rather than the acids conventionally employed in storage batteries; and its electrodes were magnesium and cuprous chloride, rather than zinc and silver chloride. The Court recognized that when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result. 383 U. S., at 50-51. It nevertheless rejected the Government's claim that Adams's battery was obvious. The Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious. *Id.*, at 51-52. When Adams designed his battery, the prior art warned that risks were involved in using the types of electrodes he employed. The fact that the elements worked together in an unexpected and fruitful manner supported the conclusion that Adams's design was not obvious to those skilled in the art.

In *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U. S. 57 (1969), the Court elaborated on this approach.

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The subject matter of the patent before the Court was a device combining two pre-existing elements: a radiant-heat burner and a paving machine. The device, the Court concluded, did not create some new synergy: The radiant-heat burner functioned just as a burner was expected to function; and the paving machine did the same. The two in combination did no more than they would in separate, sequential operation. *Id.*, at 60–62. In those circumstances, “while the combination of old elements performed a useful function, it added nothing to the nature and quality of the radiant-heat burner already patented,” and the patent failed under §103. *Id.*, at 62 (footnote omitted).

Finally, in *Sakraida v. AG Pro, Inc.*, 425 U. S. 273 (1976), the Court derived from the precedents the conclusion that when a patent “simply arranges old elements with each performing the same function it had been known to perform” and yields no more than one would expect from such an arrangement, the combination is obvious. *Id.*, at 282.

The principles underlying these cases are instructive when the question is whether a patent claiming the combination of elements of prior art is obvious. When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* and *Anderson’s Black Rock* are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

Following these principles may be more difficult in other

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cases than it is here because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

B

When it first established the requirement of demonstrating a teaching, suggestion, or motivation to combine known elements in order to show that the combination is obvious, the Court of Customs and Patent Appeals captured a helpful insight. See *Application of Bergel*, 292 F. 2d 955, 956-957 (1961). As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established

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functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

Helpful insights, however, need not become rigid and mandatory formulas; and when it is so applied, the TSM test is incompatible with our precedents. The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. The diversity of inventive pursuits and of modern technology counsels against limiting the analysis in this way. In many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature, will drive design trends. Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior inventions of their value or utility.

In the years since the Court of Customs and Patent Appeals set forth the essence of the TSM test, the Court of Appeals no doubt has applied the test in accord with these principles in many cases. There is no necessary inconsistency between the idea underlying the TSM test and the *Graham* analysis. But when a court transforms the general principle into a rigid rule that limits the obviousness inquiry, as the Court of Appeals did here, it errs.

C

The flaws in the analysis of the Court of Appeals relate

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for the most part to the court's narrow conception of the obviousness inquiry reflected in its application of the TSM test. In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim. If the claim extends to what is obvious, it is invalid under §103. One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims.

The first error of the Court of Appeals in this case was to foreclose this reasoning by holding that courts and patent examiners should look only to the problem the patentee was trying to solve. 119 Fed. Appx., at 288. The Court of Appeals failed to recognize that the problem motivating the patentee may be only one of many addressed by the patent's subject matter. The question is not whether the combination was obvious to the patentee but whether the combination was obvious to a person with ordinary skill in the art. Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

The second error of the Court of Appeals lay in its assumption that a person of ordinary skill attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem. *Ibid.* The primary purpose of Asano was solving the constant ratio problem; so, the court concluded, an inventor considering how to put a sensor on an adjustable pedal would have no reason to consider putting it on the Asano pedal. *Ibid.* Common sense teaches, however, that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a

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puzzle. Regardless of Asano's primary purpose, the design provided an obvious example of an adjustable pedal with a fixed pivot point; and the prior art was replete with patents indicating that a fixed pivot point was an ideal mount for a sensor. The idea that a designer hoping to make an adjustable electronic pedal would ignore Asano because Asano was designed to solve the constant ratio problem makes little sense. A person of ordinary skill is also a person of ordinary creativity, not an automaton.

The same constricted analysis led the Court of Appeals to conclude, in error, that a patent claim cannot be proved obvious merely by showing that the combination of elements was "obvious to try." *Id.*, at 289 (internal quotation marks omitted). When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under §103.

The Court of Appeals, finally, drew the wrong conclusion from the risk of courts and patent examiners falling prey to hindsight bias. A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning. See *Graham*, 383 U. S., at 36 (warning against a "temptation to read into the prior art the teachings of the invention in issue" and instructing courts to "guard against slipping into the use of hindsight" (quoting *Monroe Auto Equipment Co. v. Heckethorn Mfg. & Supply Co.*, 332 F. 2d 406, 412 (CA6 1964))). Rigid preventative rules that deny factfinders recourse to common sense, however, are neither necessary under our case law nor consistent with it.

We note the Court of Appeals has since elaborated a

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broader conception of the TSM test than was applied in the instant matter. See, e.g., *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367 (2006) ("Our suggestion test is in actuality quite flexible and not only permits, but *requires*, consideration of common knowledge and common sense"); *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1291 (2006) ("There is flexibility in our obviousness jurisprudence because a motivation may be found *implicitly* in the prior art. We do not have a rigid test that requires an actual teaching to combine . . ."). Those decisions, of course, are not now before us and do not correct the errors of law made by the Court of Appeals in this case. The extent to which they may describe an analysis more consistent with our earlier precedents and our decision here is a matter for the Court of Appeals to consider in its future cases. What we hold is that the fundamental misunderstandings identified above led the Court of Appeals in this case to apply a test inconsistent with our patent law decisions.

III

When we apply the standards we have explained to the instant facts, claim 4 must be found obvious. We agree with and adopt the District Court's recitation of the relevant prior art and its determination of the level of ordinary skill in the field. As did the District Court, we see little difference between the teachings of Asano and Smith and the adjustable electronic pedal disclosed in claim 4 of the Engelgau patent. A person having ordinary skill in the art could have combined Asano with a pedal position sensor in a fashion encompassed by claim 4, and would have seen the benefits of doing so.

A

Teleflex argues in passing that the Asano pedal cannot be combined with a sensor in the manner described by

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claim 4 because of the design of Asano's pivot mechanisms. See Brief for Respondents 48–49, and n. 17. Therefore, Teleflex reasons, even if adding a sensor to Asano was obvious, that does not establish that claim 4 encompasses obvious subject matter. This argument was not, however, raised before the District Court. There Teleflex was content to assert only that the problem motivating the invention claimed by the Engelgau patent would not lead to the solution of combining of Asano with a sensor. See Teleflex's Response to KSR's Motion for Summary Judgment of Invalidity in No. 02–74586 (ED Mich.), pp. 18–20, App. 144a–146a. It is also unclear whether the current argument was raised before the Court of Appeals, where Teleflex advanced the nonspecific, conclusory contention that combining Asano with a sensor would not satisfy the limitations of claim 4. See Brief for Plaintiffs-Appellants in No. 04–1152 (CA Fed.), pp. 42–44. Teleflex's own expert declarations, moreover, do not support the point Teleflex now raises. See Declaration of Clark J. Radcliffe, Ph.D., Supplemental App. 204–207; Declaration of Timothy L. Andresen, *id.*, at 208–210. The only statement in either declaration that might bear on the argument is found in the Radcliffe declaration:

"Asano . . . and Rixon . . . are complex mechanical linkage-based devices that are expensive to produce and assemble and difficult to package. It is exactly these difficulties with prior art designs that [Engelgau] resolves. The use of an adjustable pedal with a single pivot reflecting pedal position combined with an electronic control mounted between the support and the adjustment assembly at that pivot was a simple, elegant, and novel combination of features in the Engelgau '565 patent." *Id.*, at 206, ¶16.

Read in the context of the declaration as a whole this is best interpreted to mean that Asano could not be used to

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solve "[t]he problem addressed by Engelgau '565[:] to provide a less expensive, more quickly assembled, and smaller package adjustable pedal assembly with electronic control." *Id.*, at 205, ¶10.

The District Court found that combining Asano with a pivot-mounted pedal position sensor fell within the scope of claim 4. 298 F. Supp. 2d, at 592–593. Given the significance of that finding to the District Court's judgment, it is apparent that Teleflex would have made clearer challenges to it if it intended to preserve this claim. In light of Teleflex's failure to raise the argument in a clear fashion, and the silence of the Court of Appeals on the issue, we take the District Court's conclusion on the point to be correct.

B

The District Court was correct to conclude that, as of the time Engelgau designed the subject matter in claim 4, it was obvious to a person of ordinary skill to combine Asano with a pivot-mounted pedal position sensor. There then existed a marketplace that created a strong incentive to convert mechanical pedals to electronic pedals, and the prior art taught a number of methods for achieving this advance. The Court of Appeals considered the issue too narrowly by, in effect, asking whether a pedal designer writing on a blank slate would have chosen both Asano and a modular sensor similar to the ones used in the Chevrolet truckline and disclosed in the '068 patent. The District Court employed this narrow inquiry as well, though it reached the correct result nevertheless. The proper question to have asked was whether a pedal designer of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to upgrading Asano with a sensor.

In automotive design, as in many other fields, the interaction of multiple components means that changing one

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component often requires the others to be modified as well. Technological developments made it clear that engines using computer-controlled throttles would become standard. As a result, designers might have decided to design new pedals from scratch; but they also would have had reason to make pre-existing pedals work with the new engines. Indeed, upgrading its own pre-existing model led KSR to design the pedal now accused of infringing the Engelgau patent.

For a designer starting with Asano, the question was where to attach the sensor. The consequent legal question, then, is whether a pedal designer of ordinary skill starting with Asano would have found it obvious to put the sensor on a fixed pivot point. The prior art discussed above leads us to the conclusion that attaching the sensor where both KSR and Engelgau put it would have been obvious to a person of ordinary skill.

The '936 patent taught the utility of putting the sensor on the pedal device, not in the engine. Smith, in turn, explained to put the sensor not on the pedal's footpad but instead on its support structure. And from the known wire-chafing problems of Rixon, and Smith's teaching that "the pedal assemblies must not precipitate any motion in the connecting wires," Smith, col. 1, lines 35-37, Supplemental App. 274, the designer would know to place the sensor on a nonmoving part of the pedal structure. The most obvious nonmoving point on the structure from which a sensor can easily detect the pedal's position is a pivot point. The designer, accordingly, would follow Smith in mounting the sensor on a pivot, thereby designing an adjustable electronic pedal covered by claim 4.

Just as it was possible to begin with the objective to upgrade Asano to work with a computer-controlled throttle, so too was it possible to take an adjustable electronic pedal like Rixon and seek an improvement that would avoid the wire-chafing problem. Following similar steps to

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those just explained, a designer would learn from Smith to avoid sensor movement and would come, thereby, to Asano because Asano disclosed an adjustable pedal with a fixed pivot.

Teleflex indirectly argues that the prior art taught away from attaching a sensor to Asano because Asano in its view is bulky, complex, and expensive. The only evidence Teleflex marshals in support of this argument, however, is the Radcliffe declaration, which merely indicates that Asano would not have solved Engelgau's goal of making a small, simple, and inexpensive pedal. What the declaration does not indicate is that Asano was somehow so flawed that there was no reason to upgrade it, or pedals like it, to be compatible with modern engines. Indeed, Teleflex's own declarations refute this conclusion. Dr. Radcliffe states that Rixon suffered from the same bulk and complexity as did Asano. See *id.*, at 206. Teleflex's other expert, however, explained that Rixon was itself designed by adding a sensor to a pre-existing mechanical pedal. See *id.*, at 209. If Rixon's base pedal was not too flawed to upgrade, then Dr. Radcliffe's declaration does not show Asano was either. Teleflex may have made a plausible argument that Asano is inefficient as compared to Engelgau's preferred embodiment, but to judge Asano against Engelgau would be to engage in the very hindsight bias Teleflex rightly urges must be avoided. Accordingly, Teleflex has not shown anything in the prior art that taught away from the use of Asano.

Like the District Court, finally, we conclude Teleflex has shown no secondary factors to dislodge the determination that claim 4 is obvious. Proper application of *Graham* and our other precedents to these facts therefore leads to the conclusion that claim 4 encompassed obvious subject matter. As a result, the claim fails to meet the requirement of §103.

We need not reach the question whether the failure to

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disclose Asano during the prosecution of Engelgau voids the presumption of validity given to issued patents, for claim 4 is obvious despite the presumption. We nevertheless think it appropriate to note that the rationale underlying the presumption—that the PTO, in its expertise, has approved the claim—seems much diminished here.

IV

A separate ground the Court of Appeals gave for reversing the order for summary judgment was the existence of a dispute over an issue of material fact. We disagree with the Court of Appeals on this point as well. To the extent the court understood the *Graham* approach to exclude the possibility of summary judgment when an expert provides a conclusory affidavit addressing the question of obviousness, it misunderstood the role expert testimony plays in the analysis. In considering summary judgment on that question the district court can and should take into account expert testimony, which may resolve or keep open certain questions of fact. That is not the end of the issue, however. The ultimate judgment of obviousness is a legal determination. *Graham*, 383 U. S., at 17. Where, as here, the content of the prior art, the scope of the patent claim, and the level of ordinary skill in the art are not in material dispute, and the obviousness of the claim is apparent in light of these factors, summary judgment is appropriate. Nothing in the declarations proffered by Teleflex prevented the District Court from reaching the careful conclusions underlying its order for summary judgment in this case.

* * *

We build and create by bringing to the tangible and palpable reality around us new works based on instinct, simple logic, ordinary inferences, extraordinary ideas, and sometimes even genius. These advances, once part of our

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shared knowledge, define a new threshold from which innovation starts once more. And as progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts. See U. S. Const., Art. I, §8, cl. 8. These premises led to the bar on patents claiming obvious subject matter established in *Hotchkiss* and codified in §103. Application of the bar must not be confined within a test or formulation too constrained to serve its purpose.

KSR provided convincing evidence that mounting a modular sensor on a fixed pivot point of the Asano pedal was a design step well within the grasp of a person of ordinary skill in the relevant art. Its arguments, and the record, demonstrate that claim 4 of the Engelgau patent is obvious. In rejecting the District Court's rulings, the Court of Appeals analyzed the issue in a narrow, rigid manner inconsistent with §103 and our precedents. The judgment of the Court of Appeals is reversed, and the case remanded for further proceedings consistent with this opinion.

It is so ordered.

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